

WE CLAIM:

1 1. A method for determining a formation profile surrounding a well
2 bore, comprising the steps of:
3 (a) receiving field log data for a formation surrounding the well
4 bore;
5 (b) generating a Jacobian matrix responsive to the field log data;
6 (c) solving for a new formation conductivity profile using the
7 Jacobian matrix;
8 (d) calculating a new log response using the new formation
9 conductivity profile;
10 (e) determining if the log response converges with the received
11 field log data;
12 (f) performing a quasi-Newton update of the Jacobian matrix and
13 repeating step (c) and (e) if the log response does not converge with the
14 received field log data; and
15 (g) outputting the formation profile based upon the log response
16 if the log response converges with the received field log data.

1 2. The method of Claim 1, wherein the step of generating further
2 comprises the steps of:
3 determining an initial vector from the field log data, said initial
4 vector being at least one of a conductivity or resistivity vector; and
5 generating the Jacobian matrix using a sliding window and the
6 initial vector.

1 3. The method of Claim 2, wherein the method of generating the
2 Jacobian matrix using the sliding window further comprises the steps of:
3 determining a single column vector of the Jacobian matrix based
4 on a three-bed formation; and
5 sliding the single column vector across the formation to populate
6 the Jacobian matrix.

1 4. The method of Claim 1, further including the step of applying a
2 maximum flatness inversion algorithm to the received field log data.

1 5. The method of Claim 1, wherein the step of determining further
2 comprises the step of comparing the determined log response to the received
3 field log data to determine any differences therebetween.

1 6. The method of Claim 1, wherein the step of performing further
2 comprises the step of performing a quasi-Newton update responsive to the
3 determined log response and a presently existing Jacobian matrix.

1 7. A method for determining a formation profile surrounding a well
2 bore, comprising the steps of:
3 (a) receiving field log data for a formation surrounding the well
4 bore;
5 (b) determining an initial vector from the field log data, said initial
6 vector being a conductivity or resistivity vector;
7 (c) generating the Jacobian matrix using a sliding window and
8 the initial vector;
9 (d) solving for a formation conductivity vector using the Jacobian
10 matrix with maximum flatness constraint;
11 (e) calculating a log response using the new formation
12 conductivity vector;
13 (f) determining if the log response converges with the received
14 field log data;
15 (g) performing a quasi-Newton update of the Jacobian matrix
16 and repeating step (d) and (f) if the log response does not converge with the
17 received field log data; and
18 (h) outputting the formation profile based upon the log response
19 if the log response converges with the received field log data.

1 8. The method of Claim 7, wherein the method of generating the
2 Jacobian matrix using the sliding window further comprises the steps of:
3 determining a single column vector of the Jacobian matrix based
4 on a three-bed formation; and
5 sliding the single column vector across the formation to populate
6 the Jacobian matrix.

1 9. The method of Claim 7, wherein the step of determining further
2 comprises the step of comparing the determined log response to the received
3 field log data to determine any differences therebetween.

- 1 10. The method of Claim 7, wherein the step of solving further
- 2 comprises performing a gradient based iterative inversion.

1 11. A method for determining a formation profile surrounding a well
2 bore, comprising the steps of:
3 (a) receiving field log data for a formation surrounding the well
4 bore;
5 (b) determining an initial vector from the field log data, said initial
6 vector being a conductivity or resistivity vector;
7 (c) generating the Jacobian matrix using a sliding window and
8 the initial vector;
9 (d) generating the Jacobian Matrix using a sliding window and
10 the initial vector said step further comprising the steps of:
11 determining an single column vector of the Jacobian
12 matrix using a three-bed formation; and
13 sliding the single column vector across the formation to
14 populate the Jacobian matrix;
15 (e) solving for a formation conductivity vector using the Jacobian
16 matrix with maximum flatness constraint;
17 (f) calculating a log response using the new formation
18 conductivity vector;
19 (g) determining if the log response converges with the received
20 field log data;
21 (h) comparing the determined log response to the received field
22 log data to determine if the log response converges with the received field log
23 data;
24 (i) performing a quasi-Newton update of the Jacobian matrix and
25 repeating step (e) and (f) if the log response does not converge with the
26 received field log data; and
27 (j) outputting the formation profile based upon the log response
28 if the log response converges with the received field log data.